

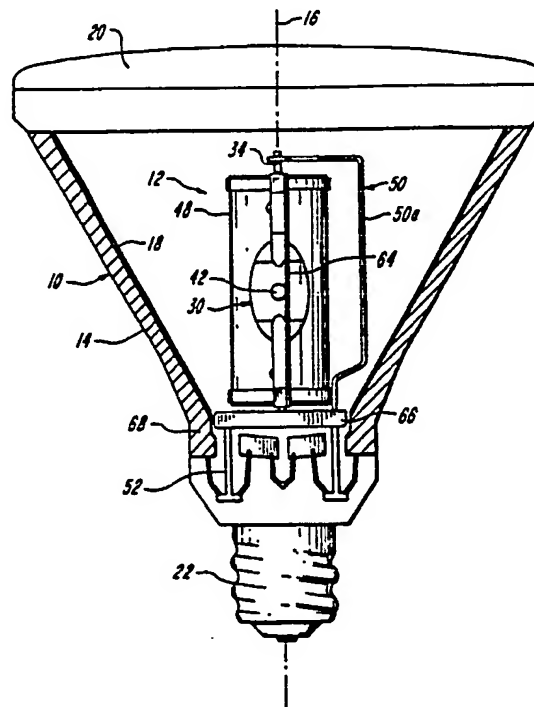


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>5</sup> :</b>  <b>H01J 61/34</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 92/10848</b>  <b>(43) International Publication Date:</b> 25 June 1992 (25.06.92)
<b>(21) International Application Number:</b> PCT/US91/08860 <b>(22) International Filing Date:</b> 25 November 1991 (25.11.91)  <b>(30) Priority data:</b> 623,312                      6 December 1990 (06.12.90)    US  <b>(71) Applicant:</b> GTE PRODUCTS CORPORATION [US/US]; 100 Endicott Street, Danvers, MA 01923 (US).  <b>(72) Inventors:</b> SCHOLZ, John, A. ; 35 Coolidge Road, Danvers, MA 01923 (US). WHITE, Robert, S. ; 12 Upland Road, Beverly, MA 01915 (US).  <b>(74) Agents:</b> LOREN, Ralph, A. ; Lahive & Cockfield, 60 State Street, Boston, MA 02109 (US) et al.		<b>(81) Designated States:</b> AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).  <b>Published</b> <i>With international search report.          Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

**(54) Title:** REFLECTOR LAMP ASSEMBLY INCLUDING METAL HALIDE ARC TUBE**(57) Abstract**

An electric lamp includes an arc tube assembly (12) mounted in a lamp envelope (10) including a reflector (14), a lens (20) and a base (22) for connection to an electrical source. The arc tube assembly (12) includes an arc tube (30) having a longitudinal axis aligned with the optical axis (16) of the reflector, a light-transmissive shroud (48) disposed around the arc tube (30), first (60) and second (62) clips attached to opposite ends of the arc tube (30), a connection member (64) attached to the first (60) and second (62) clips such that the shroud (48) is retained between the first (60) and second (62) clips in a fixed position relative to the arc tube (30), and upper and lower electrical supports (50, 52) for mechanically supporting the arc tube (30) in the lamp envelope (10) entirely from the base region and for coupling electrical energy to the arc tube (30). A support ring (66) is positioned in a heel region (68) of the lamp envelope (10) and is attached to the connection member (64). The support ring (66) cushions the arc tube (30) assembly (12) when the lamp is subjected to mechanical shock. The connection member (64) includes a connection rod having a first section (70) located outside the shroud (48) between the first (60) and second (62) clips and a second section (72) extending between the first section (70) and the support ring (66).



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+ Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

REFLECTOR LAMP ASSEMBLY INCLUDING  
METAL HALIDE ARC TUBE

5 Field of the Invention

This invention relates to electric lamps for general illumination and, more particularly, to electric lamps utilizing a metal halide arc tube 10 mounted in a sealed reflector.

Background of the Invention

Lamp assemblies incorporating reflectors are 15 well known. Examples include spotlights and floodlights for indoor and outdoor use. A lamp is mounted in a sealed outer envelope which includes a reflecting interior surface, typically parabolic, for directing light in a preferred direction. The 20 reflector is covered with a lens, and a base is provided for mounting the lamp assembly and for interconnection of the lamp assembly to an electrical energy source. Incandescent lamps, high-pressure sodium arc tubes and mercury arc tubes have been 25 utilized in such lamp assemblies.

Recently, it has been proposed to utilize metal halide arc tubes in reflector lamp assemblies. Metal halide arc tubes provide excellent color, long life and high efficiency. Low wattage halide arc 30 tube assemblies include an arc tube which encloses a suitable fill material such as sodium, scandium and mercury iodides. Electrodes are located within the arc tube at opposite ends, and electrode leads extend through press seals for connection to an electrical

source. An example of a reflector lamp assembly utilizing a metal halide arc tube is disclosed in U.S. Patent No. 4,961,019, issued October 2, 1990 to White et al.

5 It has been found desirable to mount metal halide arc tubes within a light-transmissive quartz shroud or shield. The shroud produces a higher and more uniform arc tube temperature than would otherwise occur. The shroud is, in part, responsible  
10 for the excellent color temperature and the long operating life of metal halide arc lamps. In addition, it is known that metal halide arc tubes are subject to burst on rare occasions. The shroud contains shards of the arc tube when the burst occurs.

15 When a metal halide arc tube is mounted in a reflector, several requirements must be met. It is preferred, in order to maximize light output, that the axis of the arc tube be aligned with the optical axis of the reflector and that the center of light  
20 output of the arc tube coincide with the focal point of the reflector. The mounting arrangement for the arc tube must provide means for mounting both the shroud and the arc tube. The arc tube and the shroud must be securely mounted within the lamp envelope to  
25 prevent damage during shipping and handling.

In conventional arc discharge lamps which utilize a bulbous lamp envelope, the arc tube and shroud are mechanically supported from both ends of the lamp envelope. However, the process of  
30 fabricating a reflector lamp assembly involves heating steps which cause the reflector to sag under the weight of the lens. Later in the process, a pressurized gas is introduced into the lamp envelope in order to raise the lens to a desired height. This

variation in dimensions during processing precludes the mount assembly for the arc tube and shroud from being secured to the lens.

5           It is well known that conductors located in proximity to an arc discharge tube containing sodium cause sodium migration, or sodium electrolysis. Sodium ions migrate through the wall of the arc tube and thereby reduce the life of the lamp. It has been  
10 found desirable to keep conducting frame members and power leads away from the arc tube to the extent possible. In prior lamp assemblies which do not include a reflector, a frameless construction has been utilized in which a fine wire connects the arc  
15 tube electrode at the dome end of the lamp to the electrical feedthrough at the base end of the lamp. The arc tube is maintained in position by bulb spacers at the base and dome ends of the lamp envelope. The electrically-isolated floating frame  
20 develops a positive charge which inhibits the migration of sodium ions through the arc tube. As noted above, a double-ended mechanical mount is not feasible in a reflector lamp assembly.

          It is a general object of the present  
25 invention to provide improved reflector lamp assemblies.

          It is another object of the present invention to provide reflector lamp assemblies which utilize metal halide arc discharge tubes.

30           It is a further object of the present invention to provide a metal halide reflector lamp assembly having a long operating life.

It is a further object of the present invention to provide a lamp assembly, including a metal halide arc tube and a light-transmissive shroud, suitable for mounting in a reflector.

5 It is yet another object of the present invention to provide a metal halide lamp assembly wherein all conductive parts except the electrical inleads are electrically isolated.

10 It is yet another object of the present invention to provide a metal halide reflector lamp assembly that is compatible with automatic assembly equipment.

15 It is still another of the present invention to provide a metal halide reflector lamp assembly that is capable of withstanding mechanical shock and vibration during routine shipping and handling.

It is a further object of the present invention to provide a lamp assembly, including a metal halide arc tube mounted in a reflector, that is 20 easily manufactured and low in cost.

#### Summary of the Invention

According to the present invention, these 25 and other objects and advantages are achieved in an electric lamp comprising a lamp envelope having a base region including a base for connection to an electrical source, an arc tube having an upper electrode lead and a lower electrode lead extending 30 from opposite ends thereof, a light-transmissive shroud disposed around the arc tube, the shroud having a cylindrical, open-ended configuration, first and second clips attached to opposite ends of the arc

1 tube, each of the clips including a portion for  
retaining the shroud, a connection member attached to  
the first and second clips such that the shroud is  
retained between the first and second clips in a  
5 fixed position relative to the arc tube, the  
connection member being unattached to the lamp  
envelope, and support means for mechanically  
supporting the arc tube in the lamp envelope entirely  
from the base region of the lamp envelope and for  
10 coupling electrical energy to the arc tube.

The lamp preferably includes a support ring  
attached to the connection member for limiting radial  
movement of the arc tube and the shroud relative to  
the lamp envelope when the lamp is subjected to  
15 mechanical shock. In a preferred embodiment, the  
connection member comprises a connection rod having a  
first section located outside the shroud between the  
first and second clips and a second section extending  
between the first section and the support ring.

20 The support ring preferably has an outside  
diameter that is slightly less than the inside  
diameter of the lamp envelope adjacent to the support  
ring.

In a preferred embodiment, the first and  
25 second clips each include a strap having inturned  
ends. An arcuate portion is affixed to one of the  
inturned ends, and a tab is affixed to the other of  
the inturned ends. The arcuate portion encircles a  
portion of the shroud, and the tab is attached to the  
30 connection member. The first and second clips each  
further include projections for retaining the arc  
tube.

The support means preferably comprises an upper electrode support coupled to the upper electrode lead of the arc tube and extending outside the shroud to the base, and a lower electrode support  
5 coupled to the lower electrode lead of the arc tube and extending to the base. The upper and lower electrode supports provide mechanical support of the arc tube in the lamp envelope and carry electrical energy to the arc tube.

10

#### Brief Description of the Drawing

For a better understanding of the present invention, together with other and further objects,  
15 advantages and capabilities thereof, reference is made to the accompanying drawings which are incorporated herein by reference and in which:

FIG. 1 is an elevational view, partly in cross-section, of a reflector lamp in accordance with  
20 the present invention;

FIG. 2 is a perspective view showing the arc tube assembly of the lamp shown in FIG. 1; and

FIG. 3 is an exploded view showing the arc tube, shroud, clips and connection member of the lamp  
25 shown in Fig. 1;

#### Detailed Description of the Invention

An electric lamp in accordance with the  
30 present invention is shown in FIG. 1. Detailed views of the arc tube assembly are shown in Figs. 2 and 3. A lamp envelope 10 provides a sealed enclosure for an arc tube assembly 12. The lamp envelope 10 includes a reflector 14 having circular symmetry about an



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optical axis 16. A reflecting surface 18 on the interior surface of reflector 14 typically has a parabolic shape. The reflecting surface 18 can be an aluminum coating, a dichroic reflector or any other suitable reflector. Reflector 14 is closed by a lens 20. A base 22 provides a means for supplying electrical energy to the arc tube assembly 12 and for mounting of the lamp. Typically, the lamp envelope 10 is filled with nitrogen at a pressure of approximately 400 torr. An electric lamp of the type shown in FIG. 1 is typically utilized as a downlight, a spotlight, or a floodlight for indoor or outdoor illumination.

The arc tube assembly 12 includes an arc tube 30. The arc tube 30 is typically a low-wattage metal halide lamp such as a type M100 manufactured and sold by GTE Products Corporation. Arc tube 30 encloses a discharge region 32 containing a fill material such as sodium, scandium and mercury iodides, and argon at a pressure of 100 torr. Electrodes 31 and 33 are located at opposite ends of the arc tube 30 and are coupled to external electrode leads 34 and 36 through press seals 38 and 40, respectively.

The arc tube 30 is mounted in lamp envelope 10 with its longitudinal axis on the optical axis 16 of reflector 14. Preferably, a light center 42 of arc tube 30 is positioned at the focal point of reflecting surface 18 for maximum light output in the desired direction.

The arc tube 30 is positioned within a light-transmissive shroud 48. The shroud 48 is typically fabricated of quartz and comprises a right circular cylinder that is open at both ends. Shroud

48 provides a higher and more uniform temperature during operation of arc tube 30 than would otherwise occur without the shroud. The shroud 48 is, in part, responsible for the excellent color temperature and the long operating life of metal halide arc tubes. In addition, the shroud 48 provides a containment function in the rare event of an arc tube burst. The shroud 48 absorbs energy from shards of the arc tube 30. Although the shroud 48 may be shattered by a burst arc tube, the energy of the burst is partially absorbed so that the shards are completely contained within the lamp envelope 10. Shroud 48 preferably has a wall thickness of approximately one to three millimeters.

The mounting structure for the arc tube 30 and the shroud 48 includes an upper electrode support 50 attached to electrode lead 34 and a lower electrode support 52 attached to electrode lead 36. The electrode supports 50 and 52 mechanically support the arc tube 30 within lamp envelope 10 and carry electrical energy to arc tube 30. Upper electrode support 50 extends transversely from electrode lead 34 and then extends downwardly outside shroud 48 to the base region of the lamp. Preferably, a section 50a of electrode support 50 is spaced as far as is practical from the outside surface of shroud 48 in order to minimize sodium migration which can be caused by the presence of a conducting surface in proximity to arc tube 30. Lower electrode support 52 extends transversely from electrode lead 36 and then downwardly to the base region of the lamp. The downwardly-extending portions of the electrode supports 50 and 52 are preferably located on opposite sides of the base region of the lamp envelope 10 and are welded to electrode leads 34 and 36, respectively.

The mounting structure for arc tube 30 and shroud 48 further includes an upper clip 60 and a lower clip 62 which secure arc tube 30 and shroud 48 to a connection rod 64. A support ring 66 is located 5 in a heel region 68 of the lamp envelope 10 and is attached to connection rod 64. The connection rod 64 includes a first section 70 located outside shroud 48 and attached between upper clip 60 and lower clip 62. The connection rod 64 further includes a second 10 section 72 that extends between lower clip 62 and support ring 66. The first section 70 is generally parallel to optical axis 16, and second section 72 is offset in a generally radial direction.

Each of the clips 60 and 62 is preferably 15 formed as an integral metal element including a strap 80 having inturned ends 82 and 84. An arcuate portion 86 is affixed to inturned end 82, and a tab 88 is affixed to inturned end 84. The arcuate portion 86 encircles a portion of the circumference 20 of shroud 48. The strap 80 passes over and bears against the end of shroud 48. The spacing between inturned ends 82 and 84 is the same or slightly larger than the outside diameter of shroud 48 so that shroud 48 is retained between inturned end 84 and 25 arcuate portion 86. Tab 88 is preferably welded to connection member 64. The strap 80 is provided with spaced apart projections 90 and 92 for retaining arc tube 30 between them. In a preferred embodiment, the projections 90 and 92 are generally U-shaped portions 30 which are perpendicular to strap 80. The projections 90 and 92 are spaced to receive the press seal 38 of arc tube 30. The strap 80 includes an opening 94 of sufficient size to provide clearance for electrode lead 34. Clips of the type shown in FIG. 3 are 35 disclosed in U.S. Application Serial No. 07/539,752 filed June 18, 1990.

In one example, the connection rod 64 is nickel-plated steel having a diameter of 0.050-inch. The support ring 66 can be fabricated from any relatively rigid material. In one example, a strip 5 of nickel 0.125-inch wide and 0.010-inch thick was used to form the support ring 66. The support ring 66 is positioned in the heel region 68 of the lamp envelope 10. Preferably, the outside diameter of support ring 66 is slightly less than the inside 10 diameter of heel region 68. With this arrangement, the lamp can be assembled using automatic assembly equipment. When the lamp is subjected to mechanical shock during shipping and handling, the support ring 66 comes into contact with heel region 68 and 15 cushions the arc tube assembly 12. The support ring 66 prevents the arc tube assembly 12 from being damaged or dislocated from its normal position in lamp envelope 12. In a preferred embodiment of the support ring 66, a strip of nickel 0.125-inch wide 20 and 0.010-inch thick is used to form a two-layer support ring. Where the two layers overlap, the support ring includes three layers. At the overlap region, the support ring 66 is welded to the offset portion 72 of the connection rod 64.

25 The upper clip 60, lower clip 62, connection rod 64 and support ring 66 are mechanically and electrically isolated from upper electrode support 50 and lower electrode support 52. The upper and lower electrode supports 50 and 52 are attached to the base 30 of the lamp as described in the aforementioned Patent No. 4,961,019.

While there have been shown and described what are at present considered the preferred 35 embodiments of the present invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

## Claims:

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1.           An electric lamp comprising:  
            a lamp envelope having a base region  
including a base for connection to an electrical  
source;  
5            an arc tube having an upper electrode lead  
and a lower electrode lead extending from opposite  
ends thereof; a light-transmissive shroud disposed  
around said arc tube, said shroud having a  
cylindrical, open-ended configuration;  
10           first and second clips attached to opposite  
ends of said arc tube, each of said clips including a  
portion for retaining said shroud;  
            a connection member attached to said first  
and second clips such that said shroud is retained  
15 between said first and second clips in a fixed  
position relative to said arc tube, said connection  
member being unattached to said lamp envelope; and  
            support means for mechanically supporting  
said arc tube in said lamp envelope entirely from the  
20 base region of said lamp envelope and for coupling  
electrical energy to said arc tube.
2.           An electric lamp as defined in claim 1  
further including a support ring attached to said  
25 connection member.

3. An electric lamp as defined in claim 1 wherein said first and second clips each include a strap having inturned ends, an arcuate portion affixed to one of said inturned ends and a tab  
5 affixed to the other of said inturned ends, said arcuate portion encircling a portion of the shroud, said tab being attached to said connection member, said first and second clips each further including spaced-apart projections for retaining said arc tube.

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4. An electric lamp as defined in claim 1 wherein said connection member comprises a connection rod located outside said shroud between said first and second clips.

15

5. An electric lamp as defined in claim 1 wherein said arc tube comprises a metal halide arc tube having press seal regions at opposite ends thereof.

20

6. An electric lamp as defined in claim 1 wherein said lamp envelope includes a reflecting interior surface for redirecting light from said arc tube and a lens enclosing one end thereof.

25

7. An electric lamp as defined in claim 2 wherein said support ring has an outside diameter that is slightly less than the inside diameter of said lamp envelope adjacent to said support ring.

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8. An electric lamp as defined in claim 2 wherein said connection member comprises a connection rod having a first section located outside said shroud between said first and second clips and a  
5 second section extending between said first section and said support ring.

9. An electric lamp as defined in claim 1 wherein said support means comprises:  
10 an upper electrode support coupled to the upper electrode lead of said arc tube and extending outside said shroud to said base; and  
a lower electrode support coupled to the lower electrode lead of said arc tube and extending  
15 to said base, said upper and lower electrode supports providing mechanical support of said arc tube in said lamp envelope and coupling electrical energy to said arc tube.

20 10. An electric lamp as defined in claim 9 wherein said upper electrode support is spaced from an outer surface of said shroud.

11. An electric lamp as defined in claim 1  
25 further including a support ring positioned in a heel region of said lamp envelope and having an outside diameter that is less than the inside diameter of said heel region, said support ring being attached to said connection member so as to cushion said arc tube  
30 and said shroud when the lamp is subjected to mechanical shock.

12. An electric lamp as defined in claim 2 wherein said support ring is positioned between a  
35 lower end of said shroud and said base region.

13. An electric lamp comprising:  
a lamp envelope including a reflecting surface having an optical axis, a lens and a base region, said base region including a base for  
5 connection to an electrical source;  
an arc tube having a longitudinal axis aligned with said optical axis, said arc tube including an upper electrode lead extending from a lens end and a lower electrode lead extending from a  
10 base end;  
a light-transmissive shroud disposed around said arc tube, said shroud comprising an open-ended cylinder;  
first and second clips attached to opposite  
15 ends of said arc tube, each of said clips including a portion for retaining said shroud;  
a connection member attached to said first and second clips such that said shroud is retained between said first and second clips in a fixed  
20 position relative to said arc tube, said connection member being unattached to said lamp envelope;  
a support ring attached to said connection member and positioned in a heel region of said lamp envelope;  
25 an upper electrode support coupled to the upper electrode lead of said arc tube and extending outside said shroud to said base; and  
a lower electrode support coupled to the lower electrode lead of said arc tube and extending  
30 to said base, said upper and lower electrode supports providing mechanical support of said arc tube in said lamp envelope and coupling electrical energy to said arc tube.



14. An electric lamp as defined in claim 13 wherein said support ring has an outside diameter that is slightly less than inside diameter of lamp envelope adjacent to said support ring.

5

15. An electric lamp as defined in claim 13 wherein said connection member comprises a connection rod having a first section located outside said shroud between said first and second clips and a  
10 second section between said first section and said support ring.

16. An electric lamp as defined in claim 13 wherein said arc tube comprises a metal halide arc  
15 tube having press seal regions at opposite ends thereof.





## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 91/08860

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 H01J61/34		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	H01J	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	EP,A,0 363 991 (GTE PRODUCTS CORPORATION) 18 April 1990 cited in the application see the whole document ---	1-16
A	FR,A,1 242 662 (N.V. PHILIPS' GLOEILAMPENFABRIEKEN) 22 August 1960 see page 2, left column, line 24 - line 33; figure ---	1,5,6,9, 13,16
A	EP,A,0 306 269 (GTE PRODUCTS CORPORATION) 8 March 1989  see column 4, line 29 - line 31 see column 6, line 8 - line 9 see column 6, line 50 - line 51 see column 11, line 15 - line 29; figure 12 --- -/-	1,3,5,6, 9,10,13, 16
<p><sup>9</sup> Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search 08 APRIL 1992	Date of Mailing of this International Search Report 1. 05. 92	
International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer MARTIN Y VICENTE M. <i>A. Martin</i>	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,3 250 934 (PETERSON) 10 May 1966  see column 1, line 1 - line 15 see column 1, line 42 - line 46; figures ---	1,5,13, 16
A	GB,A,828 020 (GENERAL ELECTRIC COMPANY LIMITED) 10 February 1960 see page 1; figures ---	1,3-5,9, 13,16
A	EP,A,0 104 594 (GTE PRODUCTS CORPORATION) 4 April 1984 see figure 3 ---	1,3,5, 10,13,16
A	FR,A,1 118 185 (THE GENERAL ELECTRIC COMPANY LIMITED) 1 June 1956 see page 4, right column, line 39 - line 57 see page 5, left column, line 15 - line 29; figures 1,2  ---	1,5,7,9, 11-14,16

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. US 9108860  
SA 55470**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the European Patent Office EDP file on  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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